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(71)Applicant : **MATSUSHITA ELECTRIC IND CO LTD**
(72)Inventor : **OHARA MASAHIRO**
OGAWA KOICHI
YAMAMOTO ATSUSHI
MIYAJIMA AKIO

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(54) **ANTENNA DEVICE**

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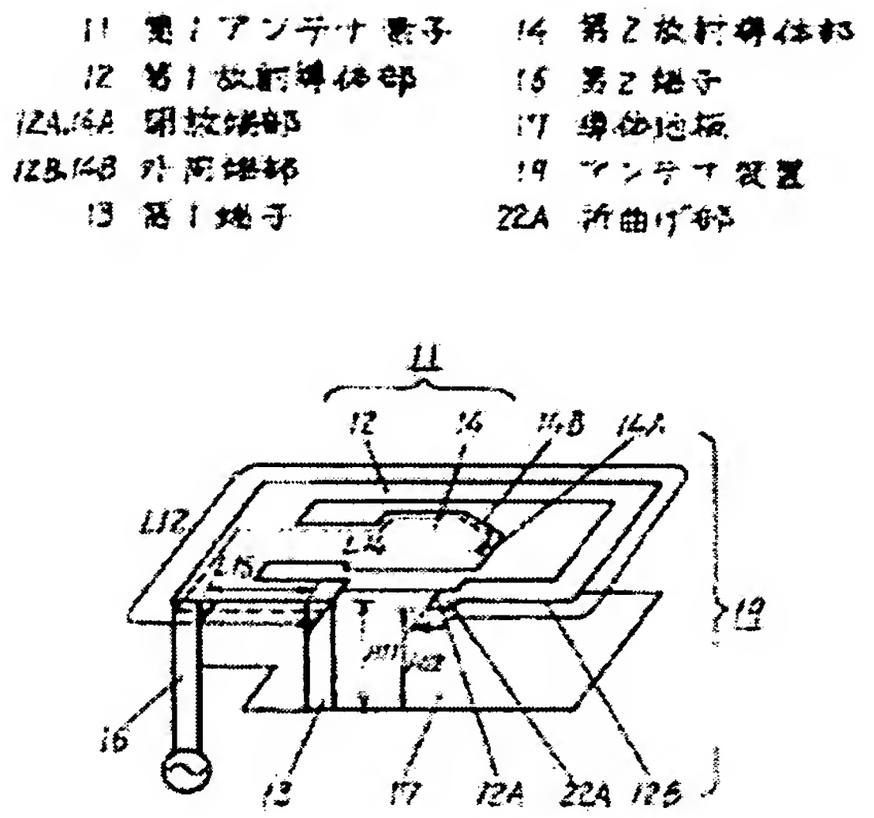
(57)Abstract:
PROBLEM TO BE SOLVED: To provide an antenna device used in a radio apparatus for mobile communication, such as cellular phones, the impedance of which is easily adjusted, having high sensitivity.
SOLUTION: The antenna apparatus 19 is constituted by forming a bending part 22A near an open end 12A of a first antenna element 11, which is provided on a conductive ground plane and is plate-shaped. Near the open end 12A, in which electric field becomes large, the opposite distance between the first antenna element 11 and the conductive ground plane is made to be different, so that its capacity nature can be changed by a large amount, and resonance frequency and its band, and impedance are easily corrected, to be able to adapt to various arrangements having high-frequency circuit parts, retaining forms other than the bending part 22A to be as it is. Thereby, the antenna apparatus 19 provided with sensitivity can be obtained.



* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1]A conductor cope plate and the 1st tabular antenna element allocated on this conductor cope plate, The 1st terminal that electrically connects this 1st antenna element and a conductor cope plate, An antenna system which separated prescribed distance from this 1st terminal, and it has been arranged, and consisted of the 2nd terminal electrically connected to a high frequency circuit section of a main part of radio equipment, and transformed at least one of a peripheral end near the open end part of said 1st antenna element, or the these and said conductor cope plates which counter.
[Claim 2]The antenna system according to claim 1 which formed the 1st antenna element in several radiation conductor parts from which electric length differs.
[Claim 3]A conductor cope plate and the 1st tabular antenna element allocated on this conductor cope plate, The 1st terminal that electrically connects this 1st antenna element and a conductor cope plate, The 2nd terminal that separate prescribed distance from this 1st terminal, and it is arranged, and is electrically connected to a high frequency circuit section of a main part of radio equipment, An antenna system which consisted of the 2nd tabular antenna element that vacated a predetermined gap and was

provided near said 1st antenna element, and transformed at least one of the parts of a peripheral end near the open end part of said 1st antenna element or said 2nd antenna element, or these and said conductor cope plate which counters.
[Claim 4]The antenna system according to claim 3 which formed either [at least] the 1st antenna element or the 2nd antenna element in several radiation conductor parts from which electric length differs.
[Claim 5]The antenna system according to claim 1 or 3 which form a case with insulating resin, and shall vacate a predetermined interval for this case, and a conductor cope plate and each antenna element shall be fixed to it, and shall be selectively different in a dielectric constant of a case.
[Claim 6]The antenna system according to claim 5 which provided a hole in a case near [at least one] a peripheral end near the open end part of an antenna element, or these and a conductor cope plate which counters.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the antenna system used mainly for the radio equipment for mobile communications, such as a cellular phone.
[0002]
[Description of the Prior Art]In recent years with the rise of demand to the radio equipment for mobile communications, such as a cellular phone. The antenna system for built-in which can be equivalent to the radio equipment of various designs is demanded similarly, and, generally what is called a tabular reverse F antenna system that made tabular the horizontal part to a conductor cope plate as the antenna system is used widely.
[0003]Such a conventional antenna system is explained using drawing 3.
[0004]In the figure, under the antenna element 1 of the size of the vertical size L1x form width L2 made from a copper alloy plate, Although the antenna element 1 and the interval H are maintained, and the conductor cope plate 2 made from a copper alloy plate is arranged in parallel and not being illustrated, a case is formed with insulating resin, and in this case, the antenna element 1 vacates the interval H and is being fixed to the conductor cope plate 2.
[0005]And the 1st terminal 3 formed in the end of the antenna element 1 is electrically connected with the conductor cope plate 2 by methods, such as soldering, and. The 2nd terminal 5 is formed from the 1st terminal 3 of the antenna element 1 at the feeding point 4 of the position of the distance L4, in the conductor cope plate 2, the hole 6 is penetrated by an insulating state, it projects in conductor cope plate 2 lower part, and the antenna system 7 is constituted.
[0006]This antenna system 7 is allocated in the main part of radio equipment (not shown), and the conductor cope plate 2 of the antenna system 7 is electrically connected to the ground part (not shown) formed in the main part of radio equipment, and. The 2nd terminal 5 of the antenna system 7 is electrically connected to the high frequency circuit section (not shown) allocated in the main part of radio equipment by methods, such as pressure welding.
[0007]In the above composition, the antenna system 7 transforms into an electrical signal the electromagnetic waves of the predetermined resonance frequency received at the time of reception, This electrical signal is inputted into the high frequency circuit section of the main part of radio equipment through the 2nd terminal 5, and the electrical signal of the predetermined resonance frequency of a high frequency circuit section is conversely transformed into electromagnetic waves at the time of transmission, and it is constituted so that it may emanate as electromagnetic waves.

[0008]Capacitivity is formed by the length of the 1st terminal 3 formed in the antenna element 1 of the antenna system 7, i.e., other portions which inductivity looked at by the interval H from the feeding point 4 of the antenna element 1 except 1st terminal 3 portion, and the resonance frequency as the antenna system 7 is defined by these.
[0009]And the size L1 of the antenna element 1 and L2 become large, and capacitivity increases, or. The interval H of the antenna element 1 and the conductor cope plate 2 becomes large, and resonance frequency will become low if inductivity increases, Conversely, the size L1 of the antenna element 1 and L2 become small, and resonance frequency will become high, if capacitivity decreases, or the interval H of the antenna element 1 and the conductor cope plate 2 becomes small and inductivity decreases.
[0010]Therefore, after determining L1, L2, and H that predetermined resonance frequency is obtained, so that it may bring close to the impedance of the high frequency circuit section of the main part of radio equipment with the most sufficient sensitivity corresponding to this resonance frequency which can be transmitted and received, By setting up the position of the feeding point 4, i.e., L4, the impedance of an antenna is determined and the antenna system 7 is constituted.

[0011]
[Problem to be solved by the invention]However, in the above-mentioned conventional antenna system 7, When the main part of radio equipment is equipped with the antenna system 7, depending on arrangement with a high frequency circuit section. Since receive the influence of change of the electromagnetic field distribution accompanying the difference between the antenna system 7 and the relative position of a high frequency circuit section, impedance changes from a predetermined value, resonance frequency and its zone change and desired sensitivity is not obtained, SUBJECT that the antenna with which form, such as L1, L2, and H, differs doubling each time was actually needed for arrangement of a high frequency circuit section occurred.
[0012]This invention solves such conventional SUBJECT.
The purpose is to provide an antenna system with easy adjustment of impedance, and good sensitivity.

[0013]
[Means for solving problem]To achieve the above objects, this invention has the following composition.
[0014]Tabular peripheral end near the open end part of the 1st antenna element where the invention of this invention according to claim 1 was allocated on a conductor cope plate, Or a folding part is formed in at least one of these and the conductor cope plates which counter, Since these intervals that counter are changed and intervals between the 1st antenna element and a conductor cope plate which meet differ in a peripheral end near the open end part which constitutes an antenna system and where electric field become large, Can change capacitivity a lot and resonance frequency, and its zone and impedance are amended easily, It has the operation that form other than a part of a peripheral end near the open end part, or these and a conductor cope plate which counters is the same, and an antenna system with good sensitivity which can respond to various arrangement with a high frequency circuit section can be obtained.
[0015]In the invention according to claim 1, the invention according to claim 2 forms the 1st antenna element in several radiation conductor parts from which electric length differs, and has the operation that an antenna system in which transmission and reception by two or more zones are possible can be provided.
[0016]The invention according to claim 3 provides the 1st tabular antenna element on a conductor cope plate, and. Vacate a predetermined gap near the 1st antenna element, and the 2nd tabular antenna element is provided, A peripheral end near the open end part of the 1st antenna element or the 2nd antenna element, Or a folding part is formed in at least one of these and the conductor cope plates which counter, these intervals that counter are changed, and an antenna system is constituted, and can amend resonance frequency, and its zone and impedance easily, and. It has the operation that a zone of

resonance frequency of the 1st antenna element and a zone of resonance frequency of the 2nd antenna element can be doubled, and a zone which can transmit and receive radio equipment can be broadband-ized.

[0017]In the invention according to claim 3, the invention according to claim 4 forms either [at least] the 1st antenna element or the 2nd antenna element in several radiation conductor parts from which electric length differs, and has the operation that an antenna system in which transmission and reception by two or more zones are possible can be provided.

[0018]In the invention according to claim 1 or 3, the invention according to claim 5 vacates a predetermined interval, and fixes a conductor cope plate and each antenna element with an insulating case, and. Since a dielectric constant of an insulating case shall be differed selectively and capacity can be changed still a lot, it has the operation that amendment of impedance can be performed in the wider range.

[0019]In the invention according to claim 5, the invention according to claim 6 A peripheral end near the open end part of the 1st antenna element or the 2nd antenna element, Or a hole is provided in an insulating case near [at least one] these and the conductor cope plate which counters, After fixing at least one deformation degree of a peripheral end near the open end part, or these and a conductor cope plate which counters and determining impedance, Even when an error of impedance arises at the time of conveyance or attachment, it has the operation that an antenna system which can amend that error can be provided using this hole.

[0020]

[Mode for carrying out the invention]Hereafter, an embodiment of the invention is described using drawing 1 and drawing 2.

[0021](Embodiment 1) using Embodiment 1 -- this invention -- invention given in Claims 1 and 2 is explained especially.

[0022]Drawing 1 is an important section perspective view of the antenna system by a 1st embodiment of this invention, and in the figure, 17 is a conductor cope plate and is formed from the laminated conductor which performed conductive metal plating of Au, nickel, etc. to electric conduction metal, such as copper, a copper alloy, an aluminum containing alloy, and a stainless alloy, or these.

[0023]And the terminal (not shown) electrically connected to the ground side of the high frequency circuit section of the main part of radio equipment (not shown) is provided in the predetermined part of this conductor cope plate 17.

[0024]11 is the 1st antenna element, it is allocated so that a predetermined interval may be maintained on the conductor cope plate 17 and it may become almost parallel, and it is formed like the conductor cope plate 17 from the laminated conductor which performed conductive metal plating to electric conduction metal or this.

[0025]And the 1st terminal 13 electrically connected to the conductor cope plate 17 at the end of this 1st antenna element 11 left lower quadrant is formed in the vertical lower part.

[0026]The 2nd terminal 16 electrically connected to the position of the distance L15 from this 1st terminal 13 at the signal input-and-output side of the high frequency circuit section of the main part of radio equipment is formed in the vertical lower part.

[0027]And the 2nd radiation conductor part 14 of the electric length L14 who is different from the electric length's L12 1st radiation conductor part 12 and this electric length L12 in this 1st antenna element 11 is formed in the same flat surface.

[0028]Near the open end part 12A of this 1st radiation conductor part 12, the folding part 22A deformed by flexion in the direction of the conductor cope plate 17 with a press etc. is formed.

[0029]And these 1st antenna element 11 and conductor cope plates 17 vacate the interval H11 with constant parts other than interval H12 of the folding part 22A of the 1st radiation conductor part 12, and the conductor cope plate 17, it is fixed with the insulating case (not shown) which consists of ABS

plastics, and the antenna system 19 is constituted.
[0030]Next, setting out of each size of the antenna system 19 of the above composition is explained.
[0031]First, the interval H11 of the electric length L12 of the 1st radiation conductor part 12 of the 1st antenna element 11, and the 1st antenna element 11 and the conductor cope plate 17 is set up so that resonance frequency may be obtained by the zone of predetermined resonance frequency, for example, 890-925 MHz.
[0032]The interval H11 of the electric length L14 of the 2nd radiation conductor part 14 of the 1st antenna element 11, and the 1st antenna element 11 and the conductor cope plate 17 is set up so that resonance frequency may be obtained by a zone of different predetermined resonance frequency from the above, for example, 1710-1880 MHz.
[0033]Therefore, 890-925 MHz of zones of resonance frequency by the 1st radiation conductor part 12 of the electric length L12 of the 1st antenna element 11, A zone in which two transmission and reception of 1710-1880 MHz of zones of resonance frequency by the 2nd radiation conductor part 14 of the different electric length L14 from this electric length L12 are possible is set to radio equipment.
[0034]And impedance of an antenna is determined after that impedance of a high frequency circuit section of a main part of radio equipment with the most sufficient sensitivity corresponding to such resonance frequency which can be transmitted and received, and by setting up a position of the 2nd terminal 16, i.e., L15, usually bring close to about 50 ohms.
[0035]However, when a main part of radio equipment is equipped with the antenna system 19, depending on arrangement with a high frequency circuit section. Influence of change of electromagnetic field distribution accompanying a difference between the antenna system 19 and a relative position of a high frequency circuit section is received, impedance changes from a predetermined value, resonance frequency and its zone change, and desired sensitivity may not be obtained.
[0036]Therefore, after opting for arrangement of a high frequency circuit section, the antenna system 19 is built into the specified position of the main part of radio equipment, When impedance is changing from the predetermined value, this impedance is amended by changing the interval H12 of the folding part 22A near the open end part 12A of the 1st radiation conductor part 12, and the conductor cope plate 17, and it is constituted so that it may become the impedance with the most sufficient sensitivity which can be transmitted and received.
[0037]The peripheral end 12B distant from the 2nd terminal 16 near the open end part 12A on electricity and magnetism the field intensity of electromagnetic waves Since it is large, Capacitivity can be changed a lot by changing the interval H12 of the folding part 22A and the conductor cope plate 17 which were formed near the open end part 12A, and impedance can be adjusted efficiently.
[0038]In the above composition, the antenna system 19 transforms into an electrical signal the electromagnetic waves of the predetermined resonance frequency received at the time of reception, This electrical signal is inputted into the high frequency circuit section of the main part of radio equipment through the 2nd terminal 16, and the electrical signal of the predetermined resonance frequency of a high frequency circuit section is conversely transformed into electromagnetic waves at the time of transmission, and it is constituted so that it may emanate as electromagnetic waves.
[0039]Thus, by according to this embodiment, forming the folding part 22A near the open end part 12A of the 1st tabular antenna element 11 allocated on the conductor cope plate, and constituting the antenna system 19, In order that electric field may change the interval between the 1st antenna element 11 and a conductor cope plate which counters near the open end part 12A which becomes large, Capacitivity can be changed a lot, resonance frequency, and its zone and impedance are amended easily, form other than folding part 22A is the same, and the antenna system 19 with good sensitivity which can respond to various arrangement with a high frequency circuit section can be obtained.
[0040]The antenna system 19 in which transmission and reception by a zone of resonance frequency of two different radio equipment are possible can be obtained by forming the 1st antenna element 11 in

the electric length's L14 different 2nd radiation conductor part 14 from the electric length's L12 1st radiation conductor part 12, and this electric length L12.
[0041]A conductor cope plate is formed in a wiring board etc. in which a high frequency circuit section of a main part of radio equipment, etc. were formed, if it constitutes so that the 1st antenna element 11 may be connected to this, the number of component parts as the whole antenna system can be reduced, and a miniaturization of a main part of radio equipment can be attained.
[0042]Although the above explanation explained as what forms the folding part 22A and amends impedance of an antenna near the open end part 12A of the 1st radiation conductor part 12, Even if a folding part is provided between the peripheral end 12B of the 1st radiation conductor part 12, and the conductor cope plate 17, or a folding part is provided between both peripheral end 12B near the open end part 12A, and the conductor cope plate 17 and it amends impedance, enforcement of this invention is possible.
[0043]Or it replaces with the 1st radiation conductor part 12, and a folding part may be provided between the peripheral end 14B near the open end part 14A of the 2nd radiation conductor part 14, and the conductor cope plate 17, or a folding part may be provided in the 1st radiation conductor part 12 and the 2nd radiation conductor part 14, and impedance may be amended.
[0044]And although the 1st antenna element 11 and the conductor cope plate 17 were explained as what was formed by a laminated conductor which performed conductive metal plating of Au, nickel, etc. to electric conduction metal, such as copper and a copper alloy, or these, A thing which formed electric conduction metal, such as copper and a copper alloy, in the surface which comprised resin in the 1st antenna element 11 and the conductor cope plate 17 by plating, printing, etc., or a film in which electric conduction metal, such as copper and a copper alloy, was formed may be stuck on resin.
[0045](Embodiment 2) using Embodiment 2 -- this invention -- invention of Claims 3 and 4 - six descriptions is explained especially.
[0046]Identical codes are given to a portion of composition and an identical configuration of Embodiment 1, and detailed explanation is omitted.
[0047]Drawing 2 is an important section perspective view of an antenna system by a 2nd embodiment of this invention, and in the figure, 17 is a conductor cope plate and is formed from a laminated conductor which performed conductive metal plating to electric conduction metal or this.
[0048]And 11 is the 1st antenna element, it is allocated so that a predetermined interval may be maintained on the conductor cope plate 17 and it may become almost parallel, and it is formed from a laminated conductor which performed conductive metal plating to electric conduction metal or this.
[0049]And the 1st terminal 13 electrically connected to the conductor cope plate 17 at the end of this 1st antenna element 11 left lower quadrant is formed in a vertical lower part, and. The 2nd terminal 16 electrically connected to the position of the distance L15 from this 1st terminal 13 at the high frequency circuit section (not shown) of the main part of radio equipment (not shown) is formed in the vertical lower part.
[0050]And the 2nd radiation conductor part 14 of the electric length L14 who is different from the electric length's L12 1st radiation conductor part 12 and this electric length L12 in this 1st antenna element 11 is formed in the same flat surface.
[0051]18 is the 2nd antenna element, and maintain a predetermined interval and it is allocated so that it may become almost parallel without carrying out direct continuation to them between the 1st antenna element 11 and the conductor cope plate 17, It is formed like the 1st antenna element 11 and the conductor cope plate 17 by the laminated conductor which performed conductive metal plating to electric conduction metal or this.
[0052]And this 2nd antenna element 18 is formed from one radiation conductor part of the electric length L13, and the folding part 28A deformed by flexion in the direction of the conductor cope plate 17 with a press etc. is formed near the open end part 18A of this 2nd antenna element 18.

[0053]And these 1st antenna element 11, the conductor cope plate 17, and the 2nd antenna element 18, The interval H11 of the 1st antenna element 11 and the conductor cope plate 17, the interval H13 of the 2nd antenna element 18 and the conductor cope plate 17, and the interval H14 of the folding part 28A of the 2nd antenna element 18 and the conductor cope plate 17 are vacated, respectively, It is fixed with the insulating case (not shown) which consists of ABS plastics, and the antenna system 29 is constituted.
[0054]Next, setting out of each size of the antenna system 29 of the above composition is explained.
[0055]First, the interval H11 of the electric length L12 of the 1st radiation conductor part 12 of the 1st antenna element 11, and the 1st antenna element 11 and the conductor cope plate 17 is set up so that resonance frequency may be obtained by the zone of predetermined resonance frequency, for example, 890-925 MHz.
[0056]Next, the interval H13 of the electric length L13 of the radiation conductor part of the 2nd antenna element 18, and the 2nd antenna element 18 and the conductor cope plate 17 is set up so that resonance frequency may be obtained by 925-960 MHz as for the high region side of the zone of predetermined resonance frequency.
[0057]That is, the zone which can transmit and receive radio equipment is broadband-ized by doubling 890-925 MHz of zones of the resonance frequency of these 1st antenna elements 11, and 925-960 MHz of zones of the resonance frequency of the 2nd antenna element 18, and acquiring 890-960 MHz of zones of predetermined resonance frequency.
[0058]The interval H11 of the electric length L14 of the 2nd radiation conductor part 14 of the 1st antenna element 11, and the 1st antenna element 11 and the conductor cope plate 17 is set up so that resonance frequency may be obtained by the zone of different predetermined resonance frequency from the above, for example, 1710-1880 MHz.
[0059]Therefore, 890-925 MHz of zones of resonance frequency by the 1st radiation conductor part 12 of the electric length L12 of the 1st antenna element 11, 890-960 MHz of zones of resonance frequency with which 925-960 MHz of zones of resonance frequency by a radiation conductor part of the electric length L13 of the 2nd antenna element 18 were doubled, A zone in which two transmission and reception of 1710-1880 MHz of zones of resonance frequency by the electric length's L14 2nd radiation conductor part 14 are possible is set to radio equipment.
[0060]And impedance of an antenna is determined after that impedance of a high frequency circuit section of a main part of radio equipment with the most sufficient sensitivity corresponding to such resonance frequency which can be transmitted and received, and by setting up L15 usually bring close to about 50 ohms.
[0061]However, when a main part of radio equipment is equipped with the antenna system 29, depending on arrangement with a high frequency circuit section. Influence of change of electromagnetic field distribution accompanying a difference between the antenna system 29 and a relative position of a high frequency circuit section is received, impedance changes from a predetermined value, resonance frequency and its zone change, and desired sensitivity may not be obtained.
[0062]Therefore, after opting for arrangement of a high frequency circuit section, the antenna system 29 is built into a specified position of a main part of radio equipment, When impedance is changing from a predetermined value, this impedance is amended by changing the interval H14 of the folding part 28A near the open end part 18A of the 2nd antenna element 18, and the conductor cope plate 17, and it is constituted so that it may become the impedance with the most sufficient sensitivity which can be transmitted and received.
[0063]In the above composition, the antenna system 29 transforms into an electrical signal the electromagnetic waves of the predetermined resonance frequency received at the time of reception, This electrical signal is inputted into the high frequency circuit section of the main part of radio equipment through the 2nd terminal 16, and the electrical signal of the predetermined resonance

frequency of a high frequency circuit section is conversely transformed into electromagnetic waves at the time of transmission, and it is constituted so that it may emanate as electromagnetic waves.
[0064]Thus, according to this embodiment, form the 1st tabular antenna element 11 on the conductor cope plate 17, and. By vacating a predetermined gap near the 1st antenna element 11, forming the 2nd tabular antenna element 18, and forming the folding part 28A near the open end part 18A of this 2nd antenna element 18, Form other than folding part 28A is the same, and can respond to various arrangement with a high frequency circuit section, and. The antenna system which doubled the zone of the resonance frequency of the 1st antenna element 11 and the zone of the resonance frequency of the 2nd antenna element 18, and broadband-ized the zone which can transmit and receive radio equipment can be obtained.
[0065]The antenna system in which transmission and reception by two or more zones are possible can be obtained by forming either [at least] the 1st antenna element 11 or the 2nd antenna element 18 in several radiation conductor parts from which electric length differs.
[0066]Although the above explanation explained as what forms the folding part 28A and amends the impedance of an antenna between the conductor cope plates 17 near the open end part 18A of the 2nd antenna element 18, Even if a folding part is provided between the peripheral end 18B of the 2nd antenna element 18, and the conductor cope plate 17, or a folding part is provided between both peripheral end 18B near the open end part 18A, and the conductor cope plate 17 and it amends impedance, enforcement of this invention is possible.
[0067]Or the peripheral end 12B near the open end part 12A of the 1st radiation conductor part 12 of the 1st antenna element 11, Or a folding part may be provided between the peripheral end 14B near the open end part 14A of the 2nd radiation conductor part 14, and the conductor cope plate 17, or a folding part may be provided also between the 1st antenna element 11, the 2nd antenna element 18 and the 2nd antenna element 18, and the conductor cope plate 17, and impedance may be amended.
[0068]The folding part 28A is formed between the 2nd antenna element 18 and the conductor cope plate 17, and also it may provide between the 2nd antenna element 18 and the 1st antenna element 11 or in its both.
[0069]And although explained as that from which predetermined sensitivity is obtained by the zone of the resonance frequency of two different radio equipment by forming the 2nd radiation conductor part 14 of predetermined resonance frequency which is different in the 1st antenna element 11, A radiation conductor part is provided in the 2nd antenna element 18, and the antenna system which can be transmitted and received may be made to be obtained by the zone of the resonance frequency of two different radio equipment instead of forming the 2nd radiation conductor part 14 in the 1st antenna element 11.
[0070]The 2nd antenna element 18 may be allocated on the 1st antenna element 11, or the 2nd antenna element 18 may be allocated in the side of the 1st antenna element 11, although it was made to be allocated between the 1st antenna element 11 and the conductor cope plate 17.
[0071]And with an insulating case, vacate a predetermined interval between the 1st antenna element 11, the 2nd antenna element 18, and the conductor cope plate 17, and fix, and. Between the 1st antenna element 11 and the 2nd antenna element 18 by differing the dielectric constant of an insulating case selectively as ABS plastics whose dielectric constant is 2.5 when air is set to 1.0, By using between the conductor cope plate 17 and the 2nd antenna element 18 as the ABS plastics of the dielectric constant 2.7 which is different in this dielectric constant 2.5, or providing a void selectively between the conductor cope plate 17 and the 2nd antenna element 18, Since capacity can be changed still a lot, amendment of impedance can be performed in the wider range.
[0072]By providing a hole in the insulating case of the lower part near the open end part 18A of the 2nd antenna element 18, Even when the error of impedance arises at the time of conveyance or attachment after fixing the deformation degree near the open end part and determining impedance, the antenna

system which can amend that error can be obtained using this hole.
[0073]
[Effect of the Invention]According to this invention, the advantageous effect that an antenna system with easy adjustment of impedance and good sensitivity can be obtained is acquired as mentioned above.